

**ANNEX
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
AMES RESEARCH CENTER
AND
VARDA SPACE INDUSTRIES
UNDER
SPACE ACT UMBRELLA AGREEMENT NO. 35784, SAA2-403669
(ANNEX NUMBER ONE)**

ARTICLE 1. PURPOSE

This Annex shall be for the purpose of utilizing NASA's expertise and facilities in supporting thermal protection material selection, design and analysis, manufacturing and advising on machining and integration.

The legal authority for this Annex, consistent with the Umbrella Agreement, is in accordance with the Space Act, Other Transactions Authority (OTA), 51 U.S.C. § 20113(e).

ARTICLE 2. RESPONSIBILITIES

A. NASA ARC will use reasonable efforts to:

Design, Analysis and TPS selection Support Activities:

Conduct analyses or review in support of the following areas:

1. Provide consultation of Thermal Protection System (TPS) selection including forebody, aftbody, antenna windows, and any coatings.
2. Explore designs of Conformal Phenolic-Impregnated Carbon Ablator (PICA) (C-PICA) TPS for the forebody aeroshell with conservative sizing to accommodate a range of entry environments.
3. Provide integration procedure for the Partner's tiled C-PICA configuration.
4. Provide review of C-PICA TPS tile layout, and develop C-PICA blanks with sufficient material for machining tiles as per the Partner's cut-plan.
5. Provide aerothermodynamics analyses of three axisymmetric cases at three points during re-entry.
6. Provide aerothermodynamics analyses of three fully 3-dimensional computational fluid dynamic (CFD) analyses at 3 points during re-entry to validate trajectory.
7. Share the know-how of the Fully Implicit Ablation and Thermal response (FIAT) restricted material model for C-PICA for earth entry to the Partner to perform its TPS sizing analysis.
8. Provide FIAT B-Prime input tables of Partner provided backshell TPS
9. Provide TPS Sizing verification for the estimated Partner provided trajectory.
10. Advise on Mission and spacecraft conceptual design.

Integration Support Activities:

Provide guidance, recommendations, and oversight in the following areas:

11. Assist Partner in the forebody tiled C-PICA TPS integration per the provided tile layout design on to the Varda carrier structure, on site at Varda.

Fabrication Support Activities:

Fabricate and deliver components in the following areas:

12. Fabricate Conformal Phenolic Infused Carbon Ablator (C-PICA) billets

B. Partner will use reasonable efforts to:

1. Partner is expected to purchase all raw materials for the fabrication of C-PICA by NASA. Chemicals to be shipped directly to NASA from the identified providers.
2. Provide all relevant vehicle and trajectory related information (trajectory, mass, design), so that NASA can verify TPS sizing and ensure TPS (C-PICA) provided is conservative.
3. Conduct LASER surface scan of assembled aeroshell pre- and post-test; if possible CT-Xray scan of aeroshell with TPS pre- and post-flight for bondline verification.
4. Provide NASA access to the post-flight article for analysis of TPS performance, including sampling, coring and potential destructive evaluation of post-flight C-PICA TPS for NASA performance analysis.
5. Provide Vehicle Outer Mold Line (OML) and aeroshell design information, which shall include size and weight goals and/or requirements, shape geometry, mechanical and electrical interfaces, other requirements, and/or other related data to enable NASA to develop the appropriate TPS integration approach (assuming no penetrations/protrusions on the forebody).
6. Provide NASA TPS preliminary design information: number of units, size(s), weight(s), material properties, layout requirements, and other requirements.
7. Invite NASA subject matter expert (SME) personnel to participate at formal reviews related to TPS/aeroshell and overall flight readiness.
8. Provide relevant mission related requirements (anything that would impact TPS sizing/selection).
9. Provide results from tests performed by Varda on all integrated testing (Thermal Vac, acoustic) and associated quality and mission assurance for review of TPS performance.

ARTICLE 3. SCHEDULE AND MILESTONES

The planned major milestones for the activities for this Annex defined in the "Responsibilities" Article are as follows:

Milestone	Estimated Completion Date
C-CPICA TPS Billets	February 2022
TPS Integration Review and On-Site Training	March 2022
Flight Article Integration Inspection	July 2022

ARTICLE 4. FINANCIAL OBLIGATIONS

- A. Partner agrees to reimburse NASA an estimated cost of \$395,158 for NASA to carry out its responsibilities under this Annex. Each payment shall be marked with Ames Research Center, Annex One, SAA2-403669-1.
- B. NASA will not provide services or incur costs beyond the current funding. Although NASA has made a good faith effort to accurately estimate its costs, it is understood that NASA provides no assurance that the proposed effort under this Annex will be accomplished for the estimated amount. Should the effort cost more than the estimate, Partner will be advised by NASA as soon as possible. Partner shall pay all costs incurred and have the option of canceling the remaining effort, or providing additional funding in order to continue the proposed effort under the revised estimate. Should this Annex be terminated, or the effort completed at a cost less than the agreed-to estimated cost, NASA shall account for any unspent funds within one year after completion of all effort under this Annex, and promptly thereafter, at Partner's option return any unspent funds to Partner or apply any such unspent funds to other activities under the Umbrella Agreement. Return of unspent funds will be processed via Electronic Funds Transfer (EFT) in accordance with 31 C.F.R. Part 208 and, upon request by NASA, Partner agrees to complete the Automated Clearing House (ACH) Vendor/Miscellaneous Payment Enrollment Form (SF 3881).

ARTICLE 5. INTELLECTUAL PROPERTY RIGHTS - DATA RIGHTS

- A. Data produced under this Annex which is subject to paragraph C. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement will be protected for the period of one year.
- B. Under paragraph H. of the Intellectual Property Rights - Data Rights Article of the Umbrella Agreement, Disclosing Party provides the following Data to Receiving Party. The lists below may not be comprehensive, are subject to change, and do not supersede any restrictive notice on the Data provided.
 - 1. Background Data: The Disclosing Party's Background Data, if any, will be identified in a separate technical document.
 - 2. Third Party Proprietary Data: The Disclosing Party's Third Party Proprietary Data, if any, will be identified in a separate technical document.
 - 3. Controlled Government Data: The Disclosing Party's Controlled Government Data, if any, will be identified in a separate technical document.
 - 4. The following software and related Data will be provided to Partner under a separate Software Usage Agreement: None

ARTICLE 6. TERM OF ANNEX

This Annex becomes effective upon the date of the last signature below ("Effective Date") and shall remain in effect until the completion of all obligations of both Parties hereto, or one year from the Effective Date, whichever comes first, unless such term exceeds the duration of the

Umbrella Agreement. The term of this Annex shall not exceed the term of the Umbrella Agreement. The Annex automatically expires upon the expiration of the Umbrella Agreement.

ARTICLE 7. RIGHT TO TERMINATE

Either Party may unilaterally terminate this Annex by providing thirty (30) calendar days written notice to the other Party.

ARTICLE 8. POINTS OF CONTACT

The following personnel are designated as the Points of Contact between the Parties in the performance of this Annex.

Management Points of Contact

NASA Ames Research Center

Nahri Ahn
Agreement Manager
Moffett Field, CA 94035
Phone: 650-604-1179
nahri.i.ahn@nasa.gov

Varda Space Industries

Eric Lasker
Head of Business Development and Federal
Relations
Eric@varda.com
Phone: 716 640 8092
433 Alaska Ave
Torrance, CA 90503-3901

Technical Points of Contact

NASA Ames Research Center

Matt Gasch
NASA Contracting Officer Rep (COR)
Moffett Field, CA 94035
Phone: 650.604.5377
matthew.j.gasch@nasa.gov

Varda Space Industries

Justin Pourkaveh
Head of Thermal
433 Alaska Ave
Torrance, CA 90503-3901
Justin@varda.com
Phone: 480 570 2381

ARTICLE 9. MODIFICATIONS

Any modification to this Annex shall be executed, in writing, and signed by an authorized representative of NASA and the Partner. Modification of an Annex does not modify the terms of the Umbrella Agreement.

ARTICLE 10. SIGNATORY AUTHORITY


The signatories to this Annex covenant and warrant that they have authority to execute this Annex. By signing below, the undersigned agrees to the above terms and conditions.

**NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
AMES RESEARCH CENTER**

BY: _____
Dr. Rupak Biswas
Director of Exploration Technology

DATE: _____

VARDA SPACE INDUSTRIES

BY:  _____
Eric Lasker
Head of Business Development and
Federal Relations

DATE: December 16, 2021